IMPROVED CONNECTOR INSERT

TO ALL WHOM IT MAY CONCERN

BE IT KNOWN THAT ROBERT A. ROUSH, citizen of the United States of America, employee of the United States Government and resident of Norwich, County of New London, State of Connecticut has invented certain new and useful improvements entitles as set forth above of which the following is a specification:

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STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefore.

CROSS REFERENCE TO OTHER PATENT APPLICATIONS

Not applicable.

BACKGROUND OF THE INVENTION

(1) Field Of The Invention

The present invention relates generally to the field of electrical connectors and more particularly, to an improved electrical connector having an integrated face seal which is especially useful in wet environments.

(2) Description Of The Prior Art

Typically, electrical connectors are constructed from a plurality of parts that are separately fabricated and then assembled together into complete connectors. If the connector is designed for outside use or use in harsh environments, it is
especially important that the connector be effectively sealed to prevent moisture, dust, or other contaminants from reaching the interior of the connector where they can cause corrosion or otherwise prevent proper operation of the connector. The need for an effective seal preventing moisture is especially great when the vehicle is in water, such as a ship or submersible vehicle.

Most environmental connectors are relatively complex in design so as to reliably seal the connection. Many environmental connectors utilize a RIM (reaction injected molded) face seal, generally made from neoprene. A common problem with these connectors results from the need to use separate seals in conjunction with the connectors. The additional seals result in increased tolerance stack-up. Also, existing seals tend to degrade over time. This results from the seals, generally made from polyurethane, cold-flowing around the receptacle’s pins over time.

Another problem associated with complex electrical connectors results from the handling and assembling of the individual components. Because the individual parts are often manufactured separately, there is an increased likelihood that certain parts will not fit together properly. This results in imperfectly-made connectors and in an excessive number of
rejects, thus increasing both manufacturing and labor costs as well as installation time.

Accordingly, what is needed is an electrical connector which effectively isolates a receptacle's pins even in a wet environment. The connector should not need additional seals which increase the tolerance stack up. The connector should be made of a material which will not cold-flow over time. Lastly, the connector should be easy to manufacture and install.

SUMMARY OF THE INVENTION

In accordance with the present invention, an electrical connector for creating a connection with a plurality of receptacle pins located on a male receptacle is disclosed. The electrical connector includes a first end and a second opposed end, a plurality of passageways extending through the electrical connector from the first end to the second end, and at least one integral face seal. The integral face seal includes a plurality of openings having a first end and a second end corresponding to the plurality of passageways and a plurality of integral semi-o-rings located on the first end of the plurality of openings. The plurality of integral semi-o-rings are adapted to frictionally engage the plurality of receptacle pins thereby isolating the plurality of receptacle pins from one another and
creating a water-proof seal. The electrical connector is molded
contiguously.

In another embodiment, the electrical connector is molded
from an o-ring material which is resistant to cold-flow. In a
preferred embodiment, the o-ring material is neoprene or Buna-N
rubber. Furthermore, the improved electrical connector is
preferably constructed using reaction injection molding
techniques.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features and advantages of the present
invention will be better understood in view of the following
description of the invention taken together with the drawings
wherein:

FIG 1 is partial cross-sectional view of an electrical
connector according to the prior art; and

FIG 2 is a partial cross-sectional view of one embodiment
of an electrical connector according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG 1 illustrates the existing connector design 10
currently used in by the U.S. Navy and others. The connector
design 10 utilizes an electrical connector housing 12 and a
separate face seal 14. The electrical connector housing 12 has
a plurality of passageways 16 extending from a first end 18 to a second end 20.

The face seal 14 is a separate component from the electrical connector housing 12. Both the electrical connector housing 12 and the face seal 14 are constructed from epoxy, generally polyurethane. The face seal 14 includes a plurality of openings 22 corresponding to the plurality of passageways 16 in the electrical connector housing 12.

In practice, the face seal 14 is placed between the electrical connector housing 12 and a corresponding electrical receptacle (not shown) having receptacle pins. Upon passing through the openings 22 of the face seal 14 to the plurality of passageways 16 in the electrical connector housing 12, the plurality of openings 22 on the face seal 14 frictionally engage the pins on the electrical receptacle creating a seal.

The prior art connection 10 described above results in increased tolerance stack-up since the face seal 14 is placed between the electrical housing 12 and the electrical receptacle. By adding the RIM, one will add to an existing stack-up (controlled by MILSPEC) which is unsatisfactory. It will interfere with sealing capabilities of the design. Also, since the electrical connector housing 12 is made of polyurethane and the face seal 14 is made of neoprene, the resulting seal degrades over time because the polyurethane cold-flows around
the electrical receptacle's face. This allows water into the connector which can result in the connection short-circuiting or performing poorly.

The improved electrical connector 30 as shown in FIG 2, is according to the present invention. It combines the electrical connector housing 32 and the face seal 34 into one contiguous piece. In a preferred embodiment, the electrical connector 30 is made from an o-ring type material which is resistant to cold-flow. The properties of the o-ring type material are listed in MIL-SPEC (military specifications). In one embodiment, the o-ring material is 60 Shore A Durometer Buna-N rubber. In another embodiment, the o-ring material is neoprene.

The electrical connector housing 32 includes a plurality of passageways 38 extending from a first end 40 to a second end 42. The face seal 34 includes a plurality of openings 36 corresponding to the plurality of passageways 38 within the electrical connector housing 32. In a preferred embodiment, each opening 44 on the face seal 34 also includes a molded-in o-ring 44 on at least the first end 40. The improved electrical connector 30 may also include additional face seals such as 14 of FIG 1 having multiple o-rings 44 on multiple ends.

In practice, the improved electrical connector 30 mates with a receptacle (not shown) in the same manner as described above, except that a separate face seal 14, FIG. 1, is not
needed. The improved electrical connector 30 creates a
waterproof seal and isolates the pins of an electrical
receptacle from one another, even in wet environments, without
the need of a separate face seal. Because of the material used,
the openings 22, FIG. 1, in the prior art face seal 14 tends to
cold-flow away from the pins on an electrical receptacle when
connected, thus degrading the quality and weatherproofness of
the seal, ultimately resulting in poor performance. Cold-flow
or creep is the tendency of a material to very slowly flow away
from a high stress area. When constructed out of an o-ring type
material, the improved electrical connector 30 will not cold-
flow or creep. Furthermore, the improved electrical connector
30 does not suffer from tolerance stack-up since the face seal
34 is an integral part of the electrical connector housing 32.

In a preferred embodiment, the improved electrical
connector 30 is constructed using reaction injection molding
techniques. However, other known methods of forming rubber
components may be used which are within the realm of a person of
ordinary skill in the art.
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ABSTRACT OF THE DISCLOSURE

An improved electrical connector having an electrical connector housing and at least one face seal, wherein the improved electrical connector is a single molded connector housing. The electrical connector housing includes a plurality of passageways extending from a first end to a second end. A face seal includes a plurality of openings corresponding to the plurality of passageways within the electrical connector housing, each passageway having a semi-o-ring on at least one side of the face seal. In a preferred embodiment, the improved electrical connector is made from an o-ring type material such as, but not limited to, neoprene or Buna-N rubber. The improved electrical connector does not need additional seals to create a waterproof seal, and therefore does not suffer from increased tolerance stack-up. Furthermore, when constructed from an o-ring type material, the improved electrical connector does not cold flow around a receptacle's pins.
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The below identified patent application is available for licensing. Requests for information should be addressed to:

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